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Studies on microlichens of Sikkim, Eastern Himalaya, India

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भारत के पूर्वी हिमालय, सिक्किम में सूक्ष्मशैवाकीय अध्ययन

जी.पी. सिन्हा एवं पूजा गुप्ता

सारांश

प्रस्तुत शोध पत्र भारत के सिक्किम राज्य से 266 सूक्ष्मशैवाक जातियों की प्राप्ति को अभिसूचित करता है। इन जातियों में से चार जातियाँ जिनमें *आकारोस्पोरा मोलिब्डिना* (अक.) ट्रेविस., *काल्विटिमेला एग्लेइआ* (सोम्मेर्फ.) हेफेल्लेनर, *आक्रोलिकिया पारेल्ला* (लि.) ए. मास्सल. एवं *पोरपिडिया फ्लाविकंडा* (अक.) गोवान भारतीय शैवाक फ्लोरा के लिये नवीन अभिलेख हैं और *आकारोस्पोरा बुल्लाटा* एंजी, *डिप्लोसिस्टिस मस्कोरम* (स्कूप.) आर. सांट., *लेसिडेल्ला स्टिग्मेटिया* (अक.) हेर्टल एवं लुर्कट, और *स्क्लिरोफोरा पैल्लिडा* (पेर्यस.) वाई. जे. याओ एवं स्पूनेर सिक्किम राज्य के लिये नवीन अभिलेख हैं।

ABSTRACT

The paper reports the occurrence of 266 species of microlichens from the state of Sikkim, India. Four species viz. *Acarospora molybdina* (Ach.) Trevis., *Calvitimela aglaea* (Sommerf.) Hafellner, *Ochrolechia parella* (L.) A. Massal. and *Porpidia flavicunda* (Ach.) Gowan are new records for Indian lichen flora and *Acarospora bullata* Anzi, *Diploschistes muscorum* (Scop.) R. Sant., *Lecidella stigmatia* (Ach.) Hertel & Leuckert and *Sclerophora pallida* (Pers.) Y.J. Yao & Spooner are new to Sikkim.

Keywords: Eastern Himalaya, Lichen biota, New records, Sikkim.

INTRODUCTION

Sikkim with an area of about 7096 sq. km located in eastern Himalaya between 27° 5′ to 28° 9′ N latitude and 87° 9′ to 88° 56′ E longitude is part of a global hotspot of biodiversity. Several sporadic publications on lichen floristic (Nylander, 1860, 1863; Chopra, 1934; Asahina, 1966; Awasthi, 1988, 1991, 2007; Sinha, 1999, 2004a, b; Sinha & Chauhan, 1996, 1998; Sinha & Elix, 2003; Divakar & al., 2001, 2003; Upreti & al., 2004; Sinha & Singh, 2005) were made from the state. A comprehensive lichen flora was attempted by Botanical Survey of India. Sinha & Singh (2005) published macrolichens of Sikkim. The present work on microlichens of Sikkim was initiated during 2006 to fulfil the gap in this regard. During the present study on microlichens, publication of several novelties in the form of new species, new records for India and Sikkim were reported (Sinha & Jagadeesh Ram 2011; Joseph & Sinha, 2012a 7 b; 2015; Joseph & al., 2015; S. Gupta & Singh, 2013; P. Gupta & Sinha, 2015a, b, c) and the comprehensive listing revealed occurrence of 266 species belonging to 80 genera under 41 families in the state. Graphidaceae is the most dominant family with 59 species, followed by Lecanoraceae (27 spp.), Arthoniaceae

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(23 spp.), Pyrenulaceae & Pertusariaceae (20 spp. each) and Pilocarpaceae & Porinaceae (10 spp. each). At generic level *Graphis* with 34 species shows maximum species diversity, followed by *Lecanora* (25 spp), *Pertusaria* & *Pyrenula* (20 spp. each), Porina (10 spp.) and *Strigula* & *Bacidia* (9 spp. each). Similarly on the basis of habitat 196 species are corticolous, followed by 37 foliicolous, 25 saxicolous and 6 terricolous species. Four species viz. *Acarospora molybdina* (Ach.) Trevis., *Calvitimela aglaea* (Sommerf.) Hafellner, *Ochrolechia parella* (L.) A. Massal. and *Porpidia flavicunda* (Ach.) Gowan have been found as new record for the Indian lichen flora and 4 species viz. *Acarospora bullata* Anzi, *Diploschistes muscorum* (Scop.) R. Sant., *Lecidella stigmatia* (Ach.) Hertel & Leuckert and *Sclerophora pallida (*Pers.) Y.J. Yao & Spooner as new distributional records for Sikkim which are provided with brief taxonomic description to facilitate their identification. Besides, all the species of microlichens known so far from Sikkim have also been enumerated (Table 1).

MATERIAL AND METHODS

Specimens collected during various exploration tours, were processed, identified and deposited at BSI, SHRC (BSHC); BSI, CRC (BSA). Besides, few lichen specimens deposited at LWG were also consulted and included in the present study. The specimens were identified based on their morphological, anatomical and chemical characters. The morphological characters were studied with the help of Nikon SMZ 1600 stereo microscope while anatomical characters were studied by Nikon Eclipe 50i compound microscope. The sections were mounted in water for measurement of anatomical structure. Chemical characters were studied using 5% potassium hydroxide (K) and 5% Lugol's (I), calcium hypochlorite (C) and para-phenylene diamine (P) solutions followed by thin layer chromatographic analysis (TLC) carried out in solvent system C following the method of Orange & al. (2001).

TAXONOMIC TREATMENT

New Records for India

1. Acarospora molybdina (Ach.) Trevis., 1851. *Lecanora molybdina* Ach., Lich. Univ.: 430. 1810. (Fig. 1)

Thallus crustose, saxicolous, areolate to rimose-areolate, squamulose at margin, dark brown-black, plane to convex; squamules 2–3 mm across; upper cortex paraplectenchymatous, 12–20 µm thick, dark brown; cells 3–4 layered; algal layer even, cells rounded 4–4.5 × 2.3 µm; medulla white.

Apothecia immersed, rounded to angular, 1–3 per areole; disc blackish brown, plane to concave, smooth; epihymenium brown to dark brown, 10–20 µm thick; hymenium hyaline, 68–80 µm high; hypothecium pale yellow, 10–45 µm thick; paraphyses moniliform, 1.2–2.48 µm thick at base, apices 3.2–4.34 µm thick; asci ±100 spored, cylindrical 50–75 × 10–26 µm; ascospores hyaline, simple, narrowly ellipsoid, 3–6 × 1–2.5 µm. Pycnidium filled with grannules or crystals. Thallus K–, C–, KC–, P–, UV–; no lichen substances detected by TLC.

The species was earlier reported from Nepal in Mt. Everest region (D.D. Awasthi 1991), Great Britain, Europe, Scandinavia, Svalbard, North America and now from India.

Specimen examined: India: North Sikkim, Llonak valley, Muguthang, 4500 m, 1 September 1999, *G.P.Sinha* 1564 (BSHC).

2. Calvitimela aglaea (Sommerf.) Hafellner, Stapfia 76: 151. 2001. *Lecidea aglaea* Sommerf., Suppl. Fl. Lapp. (Oslo): 144. 1826. (Fig. 2)

Thallus crustose, corticolous, warted, areolate; areoles continuous, rarely scattered; light greenish grey, up to 2 mm diam.; prothallus absent. Apothecia rounded, black, 0.5–3 mm diam.; disc black, plane, becoming irregularly convex; margin biatorine; thalline exciple present, with crystals; proper exciple not distinct; epihymenium dark greenish-brown, 20–36 µm thick; hymenium pigmented, 80–85 µm high, I+ blue; subhymenium brown, 20–25 µm thick; hypothecium dark brown, 60–70 µm thick; paraphyses branched, septate, tip swollen, anastomosing; asci clavate, 8–spored, uniseriate–biseriate, I–, KI+ dark blue, *Lecanora*-type; ascospores colourless, simple, 6–7 × 4–5 µm. Thallus K+ yellow, C–, KC+ yellow, P–; atranorin and usnic acid present.

The species was earlier reported from British Isles, European mountains, Arctic, Northern America, North Asia, Nepal and now from India.

Specimen examined: India: North Sikkim, Llonak Valley, Chhaber Lake, below LunaLa, 3 September 1999, *G.P. Sinha* 1616 (BSHC).

3. Ochrolechia parella (L.) A. Massal., Ric. Auton. Lich. Crost. 30. 1852. *Lichen parellus* L., Mant. Pl. 1: 132. 1767. (Fig. 3)

Thallus crustose, corticolous, rimose, continuous, warty, dark bluish-grey; isidia or soredia absent. Apothecia sessile, rounded, up to 2 mm diam.; disc concave, covered by yellowish-brown pruina; margin prominent, warty; exciple colourless–greenish, outside pale brown, 270 µm wide; epihymenium colourless; hymenium pale to colourless, 51–65 µm high; paraphyses branched, anastomosing; asci 4–8 spored; ascospores colourless, oblong-ellipsoid, thick walled, 55–90 × 35–50 µm. Thallus K+ yellow, C–, KC+ yellow; medulla K–, C–, KC–; disc K+ yellow, C+ red, KC+ red, UV–.

The species was earlier reported from Canada, USA, Europe and now from India.

Specimen examined: India: West Sikkim, Phitang-Dzongri, 3 km trek, 3900–4025 m, 12 May 1994, *G.P. Sinha* 244 (BSHC).

4. Porpidia flavicunda (Ach.) Gowan, Bryologist 92(1): 43. 1989. *Lecidea flavicunda* Ach., Lich. Univ.: 166. 1810. (Fig. 4)

Thallus crustose, saxicolous, areolate, cracked, orange-rusty; areoles angular, pale. Apothecia rounded, immersed to erumpent, black, 1–1.5 mm diam.; disc concave, dark brown-black, partly pruinose; margin smooth; exciple dark brown, 174–179 µm wide; epihymenium brownish; hymenium colourless to pale, 136–140 µm high; hypothecium colourless, 54–56 µm thick; asci clavate, 8–spored; ascospores colourless, simple, broadly ellipsoid, 25–47 × 8–25 µm, epispore 3–5 µm thick. Thallus and medulla K–, C–, KC–, P–.

The species was earlier known from Europe, North America, Japan and now from India.

Specimen examined: India: North Sikkim, Sebu La base camp, east side, 4960 m, 23 July 1996, *G.P. Sinha* 1233 (BSHC).

New distributional records

1. Acarospora bullata Anzi, Atti Soc. Ital. Sci. Nat. 11: 165. 1868.

Thallus crustose, saxicolous, orbicular, lobate at periphery, centrally rimulose-areolate, marginal lobes 1–2 mm long, 1 mm wide. Apothecia sunken in central areoles, with prominent margin, lecanorine; paraphyses simple, swollen, moniliform at apices; asci multispored; ascospores colourless, small, simple, globose, 3–5 × 1–1.5 µm. Thallus K–, C–, KC–, P–, UV.

Distribution: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Italy and Switzerland.

Specimen examined: India: North Sikkim, Sebu La base camp, east side, 4960 m, 23 July 1996, *G.P.Sinha* 1229 (BSHC).

2. Diploschistes muscorum (Scop.) R. Sant. in D. Hawksw. & al., Lichenologist 12(1): 106. 1980. *Lichen muscorum* Scop., Fl. Carniol., Edn 2 (Wien) 2:365. 1772.

Thallus crustose, musicolous or terricolous, cracked, areolate, even-verruculose, yellowish-grey. Apothecia urceolate, 1–1.2 mm diam.; disc black, slightly pruinose; thalline exciple not raised above the thallus; margin prominent, concolorous with disc; hymenium colourless–pale brownish; hypothecium dark brown; praphyses simple, capitate, brown at apices; asci 4–spored; ascospores brown, ellipsoid, submuriform, transversely 5 and longitudinally 0–2 septate, 25–33 × 10–15 µm. Thallus K+ yellow turning red, C+ red, P–, UV–.

Distribution: India: Jammu & Kashmir, Himachal Pradesh, Kerala and Uttarakhand; Bhutan, Great Britain, Nepal and New Zealand; Africa, North and South America.

Specimens examined: India: North Sikkim, Llonak valley, Muguthang to Naku lake, 4500 m, 2 April 1999, *G.P. Sinha* 1543, 1544 (BSHC).

3. Lecidella stigmatia (Ach.) Hertel & Leuckert, Willdenovia 5: 375. 1969. *Lecidea stigmatea* Ach., Lich. Univ.: 161. 1810.

Thallus crustose, saxicolous, rough, rimose, yellowish-brown, black. Apothecia rounded, sessile, lecideine, 0.8–1.3 mm diam.; disc black, strongly convex; exciple indistinct; epihymenium greenish-black, 12–15 µm thick; hymenium colourless; hypothecium pale to brownish; paraphyses simple to branched, thick, warty at apices,; asci clavate, 8–spored, 60–66 × 15–18 µm; ascospores colourless, simple, ellipsoid, 8–10 × 3–5 µm. Thallus K–, C–, KC–, P–.

Distribution: India: Himachal Pradesh and Jammu & Kashmir; Afganistan, Australia, China, Great Britain, Greece, Mongolia, Nepal, New Zealand and Pakistan; Scandinavia; Africa, Antarctica, North and South America.

Specimen examined: India: North Sikkim, Llonak Valley, Muguthang, 4500 m, 1 September 1999, *G.P. Sinha* 1567 (BSHC).

4. Sclerophora pallida (Pers.) Y.J. Yao & Spooner, Kew Bull. 54(3): 688. 1999. *Calicium pallidum* Pers., Ann. Bot. (Usteri) 7: 20. 1794.

Thallus crustose, corticolous, whitish-grey, thin; photobiont *Trentepohlia*. Apothecia brown to blackish, stalked, stalk *ca* 1 mm long; capitulum globose,

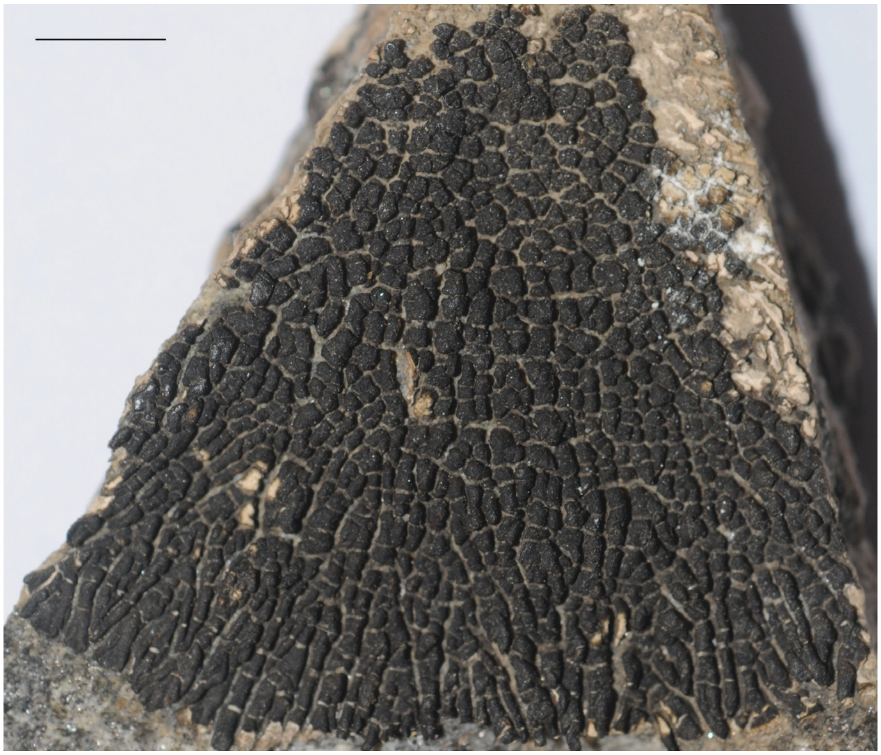

Fig. 1: *Acarospora molybdina* (Ach.) Trevis. Scale bar = 1cm

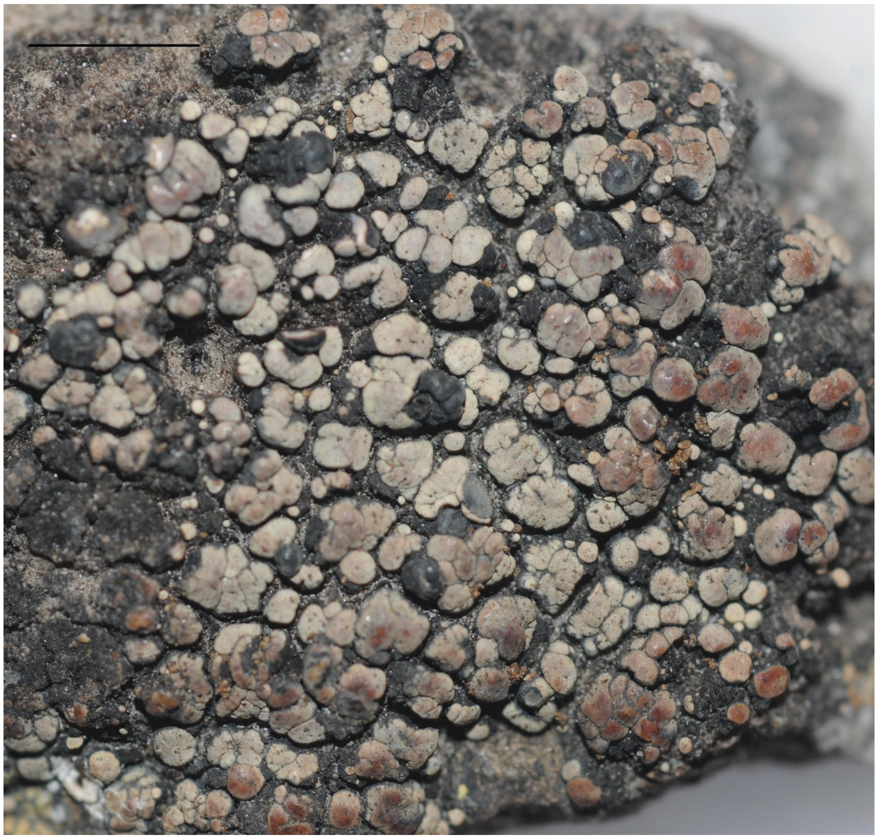

Fig. 2: *Calvitimela aglaea* (Sommerf.) Hafellner Scale bar = 1cm

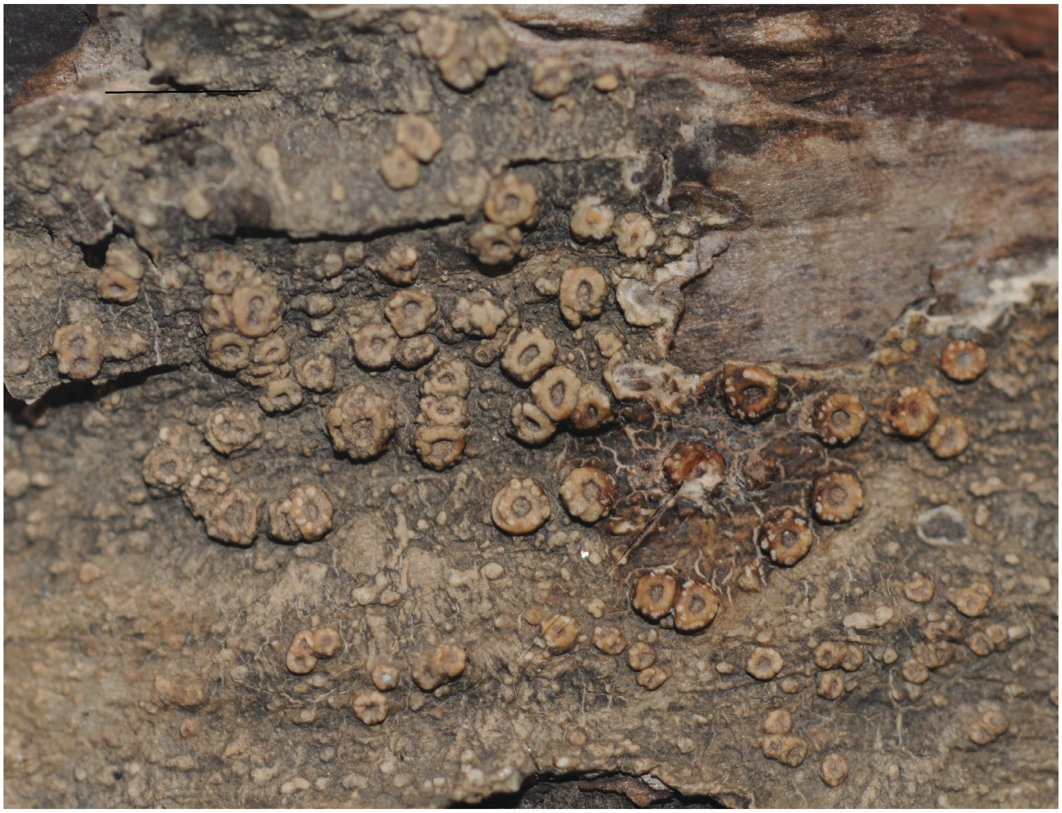

Fig. 3: *Ochrolechia parella* (L.) A. Massal. Scale bar = 0.5 cm

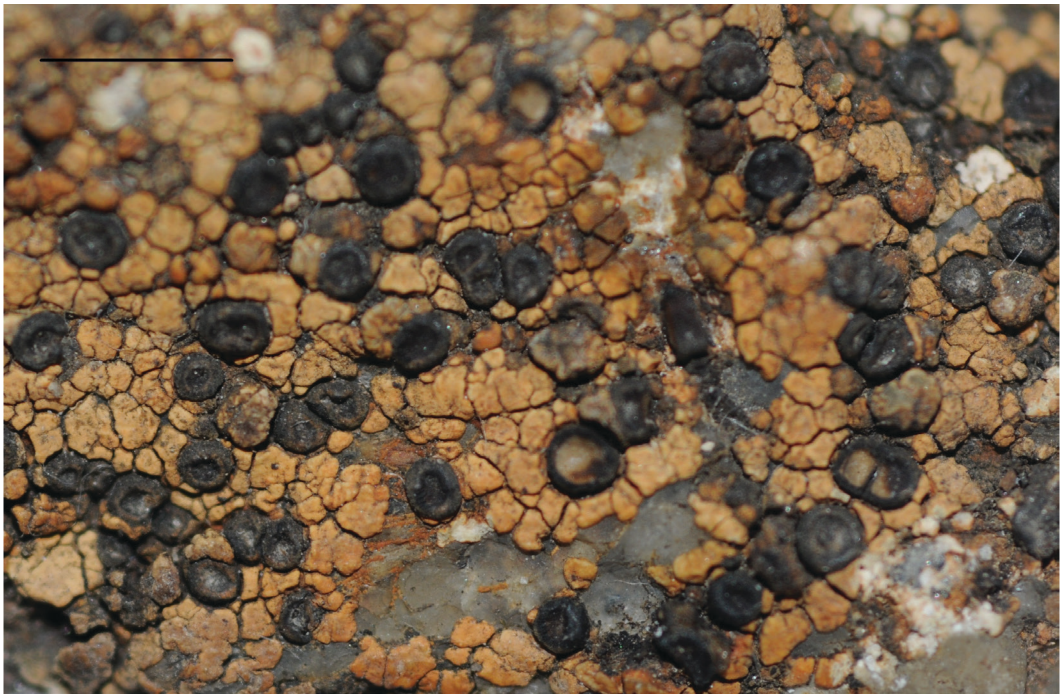

Fig. 4: *Porpidia flavicunda* (Ach.) Gowan. Scale bar = 0.5cm

orange-yellow, 0.24–0.32 mm diam., K+ yellow turning reddish, with whitish pruinose ring at the neck of capitulum; asci narrowly cylindrical 38 × 3–4 µm; ascospores colourless, simple, globose, ornamented, 4–6 µm across. Thallus K+ slightly red, C–, KC–, P–.

Distribution: India: Uttarakhand; Nepal and Norway.

Specimen examined: North Sikkim, Lauchung-Dombiyang Valley bridge area (near Yakche), alt. 3040 m, 20 March 2012, *G.P. Sinha* 7186 (BSA).

Table 1. Enumeration of microlichens of Sikkim

SI. no.	Lichen species	Family	Hb	Gf	E	Acce. No.	Loca–tion
[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
1	**Acanthothecis subconsocians** Pooja Gupta & G.P. Sinha	Graphidaceae	C	Cr	E	3621 BSA	ES
2	***Acarospora bullata** Anzi	Acarosporaceae	S	Cr		1229 BSHC	NS
3	****Acarospora molybdina** (Ach.) Trevis.	“	C	Cr		1564 BSHC	NS
4	**Aderkomyces albostrigosus** (R. Sant.) Lücking & al.	Gomphillaceae	S	Cr		417 BSHC	SS
5	**Aderkomyces sikkimensis** Pinokiyo & al.	“	F	Cr	E	475 BSHC	SS
7	**Arthonia dispersula** Nyl.	Arthoniaceae	C	Cr		01-217561 LWG	ES
8	**Arthonia cinnabarina** (DC) Wallr.	“	C	Cr		5639 BSA	ES
9	**Arthopyrenia analepta** (Ach.) A. Massal.	Arthopyreniaceae	C	Cr		5744 BSA	ES
10	**Arthothelium chiodectoides** (Nyl.) Zahlbr.	Arthoniaceae	C	Cr		2277101 LWG	ES
11	**Arthothelium confertum** (A.L.Sm.) Makhija & Patw.	“	C	Cr	E	3725 BSA	ES
12	**Arthothelium consociatum** Makhija & Patw.	“	C	Cr	E	3641 BSA	ES
13	**Arthothelium deplanatum** (Mull. Arg.) Makhija & Patw.	“	C	Cr	E	09-217574B LWG	ES
14	**Arthrorhaphis vacillans** Th.Fr. & Almq. ex Th.Fr.	Arthrorhaphidaceae	S	Cr		469 BSHC	NS
15	**Aspicilia almorensis** Räsänen	Megasporaceae	S	Cr	E	1128 BSHC	NS
16	**Aspicilia caesiocinerea** (Nyl. ex Malbr.) Arnold	“	S	Cr		1225 BSHC	NS
17	**Aspicilia calcarea** (L.) Sommerf.	“	F	Cr		20-77119 LWG	ES
18	**Asterothyrium decipiens** (Rehm) R. Sant.	Asterothyriaceae	F	Cr		155 BSHC, 301 BSHC	ES, NS
19	**Aulaxina microphana** (Vain.) R. Sant.	Gomphillaceae	F	Cr		476A BSHC	SS
20	**Bacidia alutacea** (Kremp.) Zahlbr.	Ramalinaceae	C	Cr		380 BSHC	WS
21	**Bacidia arceutina** (Ach.) Rehm & Arnold	“	C	Cr		3818 BSA	SS
22	**Bacidia convexula** (Mull. Arg.) Zahlbr.	“	C	Cr		3648 BSA	ES
23	**Bacidia heterochroa** (Müll. Arg.) Zahlbr.	“	C	Cr		3812 BSA	SS
24	**Bacidia incongruens** (Stirt.) Zahlbr.	“	C	Cr		3835 BSA	ES
25	**Bacidia laurocerasi** (Delise ex Duby) Vain.	“	C	Cr		3813C BSA	SS
26	**Bacidia nigrofusca** (Müll. Arg.) Zahlbr.	“	C	Cr		77064 LWG	ES

SI. no.	Lichen species	Family	Hb	Gf	E	Acce. No.	Loca–tion
27	**Bacidia phaeolomoides** (Müll. Arg.) Zahlbr.	“	C	Cr		3650 BSA	NS
28	**Bacidia rubella** (Hoffm.) A. Massal.	“	C	Cr		1779A BSHC	ES
29	**Baculifera curtisii** (Tuck.) Marbach	Caliciaceae	F	Cr		77082A LWG	ES
30	**Bapalmuia palmularis** (Müll. Arg.) Sérus.	Pilocarpaceae	C	Cr		265A BSHC	SS
31	**Buellia leptocline** (Flot.) Körb.	Caliciaceae	F	Cr		01-67249 LWG	ES
32	**Byssoloma leucoblepharum** (Nyl.) Vain.	Pilocarpaceae	F	Cr		470C BSHC	SS
33	**Byssoloma subdiscordans** (Nyl.) P. James var. **subdiscordans**	“	C	Cr		297BSHC , 419A BSHC	NS, SS
34	**Calicium abietinum** Pers.	Caliciaceae	C	Cr		20-77082 LWG	ES
35	**Caloplaca bassiae** (Willd. ex Ach.)Mahler.	Teloschistaceae	C	Cr		01-219572 LWG	SS
36	**Caloplaca flavorubescens** (Huds.) J.R. Laundon	“	C	Cr		3784 BSHC	SS
37	**Caloplaca maura** Poelt & Hinter.	“	S	Cr		04-004004 LWG	NS
38	**Caloplaca saxicola** (Hoffm.) A. Nordin	“	S	Cr		20-77122 LWG	ES
39	**Caloplaca scotoplaca** (Nyl.) H. Magn.	“	C	Cr		20-77145 LWG	ES
40	**Caloplaca squamosa** (de Lesd.) Zahlbr.	“	C	Cr		7239 BSHC	WS
41	** **Calvitimela aglaea** (Sommerf.) Hafellner	Tephromelataceae	C	Sq		1616 BSHC	NS
42	**Candelariella aurella** (Hoffm.) Zahlbr.	Candelariaceae	T	Sq		1595 BSHC	NS
43	**Candelariella grimmiae** Poelt & Reddi	“	C	Cr		1590 BSHC	NS
44	**Candelariella sorediosa** Poelt & Reddi	“	C	Cr		844 BSHC, 1192 BSHC	WS, NS
45	**Candelariella vitellina** (Ehrh.) Müll. Arg.	“	C	Cr		1181 BSHC	NS
46	**Chapsa leprocarpa** (Nyl.) A. Frisch	Graphidaceae	C	Cr		5569C BSA	ES
47	**Chapsa pseudophlyctis** (Nyl.) A. Frisch	“	C	Cr		3642 BSA	ES
48	**Chiodecton** aff. **leptosporum** Müll. Arg.	Roccellaceae	C	Cr		3687 BSA	ES
49	**Chrysothrix candelaris** (L.) J.R. Laundon	Chrysotrichaceae	C	Cr		20-77022B LWG	ES
50	**Chrysothrix chlorina** (Ach.) J.R. Laundon	“	C	Cr		22-77022 B LWG	ES
51	**Coenogonium luteum** (Dicks.) Kalb & Lücking	Coenogoniaceae	F	Cr		156 BSA	ES
52	**Coenogonium zonatum** (Müll. Arg.) Kalb & Lücking	“	F	Cr		513D BSA	WS
53	**Cryptothecia candida** (Kremp.) R. Sant.	Arthoniaceae	C	Cr		366B BSA	ES
54	**Cryptothecia farinosa** Jagadeesh & al.	“	C	Cr	E	3756 BSA	ES
55	**Cryptothecia monospora** (Vain.) Makhijia & Patw.	“	C	Cr		3627 BSA	ES
56	**Cryptothecia porosa** Makhijia & Patw.	“	C	Cr		3757 BSA	ES
57	**Cryptothecia scripta** G. Thor	“	C	Cr		3608 BSA	ES
58	**Cryptothecia stirtonii** A.L. Sm.	“	C	Cr		6194 BSA	ES
59	**Dimelaena oriena** (Ach.) Norman	Physciaceae	S	Cr		1166 BSHC	NS

SI. no.	Lichen species	Family	Hb	Gf	E	Acce. No.	Loca–tion
60	**Diorygma heiroglyphicum** (Pers.) Staiger & Kalb	Graphidaceae	C	Cr		5569C, 3788 BSA	ES, SS
61	**Diorygma junghuhnii** (Mont. & Bosch.) Kalb & al.	“	C	Cr		517C BSHC, 3653A BSA	ES, SS
62	**Diorygma megasporum** Kalb & al.	“	C	Cr		294, 517B BSHC	WS, ES
63	**Diploschistes cinereorcaesius** (Sw. ex Ach.) Vain**.**	“	T	Cr		20-77187 LWG	ES
64	*__Diploschistes muscorum__ (Scop.) R. Sant.	“	T	Cr		1543 BSHC	NS
65	**Diploschistes rampoddensis** (Nyl.) Zahlbr.	“	S	Cr		454 BSHC	WS
66	**Diploschistes scruposus** (Schreb.) Norman	“	S	Cr		20-77153 LWG	ES
67	**Echinoplaca epiphylla** Fée	Gomphillaceae	F	Cr		364A BSA, F433 BSA, F538 BSA	ES, SS, WS
68	**Echinoplaca pellicula** (Müll. Arg.) R. Sant.	“	F	Cr		F421B BSA, F506 BSA	SS, WS
69	**Echinoplaca streimannii** Sérus.	“	F	Sq		F4218A, F518B	SS, WS
70	**Endocarpon subrosettum** Ajay Singh & Upreti	Verrucariaceae	S	Sq		1084 BSHC	NS
71	**Fellhanera bouteillei** (Desm.) Vĕzda	Pilocarpaceae	F	Cr		343B BSA, 292A BSA	ES, NS
72	**Fellhanera semecarpi** (Vain.) Vĕzda	“	F	Cr		F306 BSA	NS
73	**Fissurina dumastii** Fée	Graphidaceae	C	Cr		363 A BSA	ES
74	**Fouragea filicina** (Mont.) Trevis.	Opegraphaceae	C	Cr		F354A BSA	ES
75	**Glyphis cicatricosa** Ach.	Graphidaceae	C	Cr		3605 BSA	ES
76	**Glyphis confluens** Zenk.	“	C	Cr		01-216569 LWG	ES
77	**Glyphis scyphulifera** (Ach.) Staiger	“	C	Cr		3617 BSA	ES
78	**Graphis acharii** Fée	“	C	Cr		1950 CAL, 3804 BSA	ES, SS
79	**Graphis albidofarinacea** Adaw. & Makhija	“	C	Cr	E	290 BSHC	WS
80	**Graphis albissima** Mull. Arg.	“	C	Cr		3840 BSA	ES
81	**Graphis aurita** Eschw.	“	C	Cr		01-67268 LWG	ES
82	**Graphis bipartita** (Müll. Arg.) Lücking	“	C	Cr		3736 BSA	ES
83	**Graphis chlorotica** A. Massal & Kremp.	“	C	Cr		5826 B BSA	NS
84	**Graphis dendrogramma** Nyl.	“	C	Cr		01-26677 LWG	SS
85	**Graphis dimidiata** Vain.	“	C	Cr		3612B BSA	ES
86	**Graphis furcata** Fée	“	C	Cr		5836B BSA	NS
87	**Graphis garoana** Nagarkar & Patw.	“	C	Cr		Bajpai & al. 2011	SS
88	**Graphis glaucescens** Fée	“	C	Cr		3813B BSA	SS
89	**Graphis illinata** Eschw.	“	C	Cr		4474 BSA	ES
90	**Graphis intricata** Fée	“	C	Cr		01-217565A LWG	ES
91	**Graphis japonica** (Müll. Arg.) A.W. Archer & Lücking	“	C	Cr		5645A BSA	ES

SI. no.	Lichen species	Family	Hb	Gf	E	Acce. No.	Loca– tion
92	**Graphis leptoclada** Müll. Arg.	“	C	Cr		5727 BSA	ES
93	**Graphis librata** C. Knight	“	C	Cr		3612 BSA	ES
94	**Graphis longiramea** Müll. Arg.	“	C	Cr		3606A BSA	WS
95	**Graphis macella** Kremp.	“	C	Cr		4483 BSA	WS
96	**Graphis marginata** Raddi	“	C	Cr		01-219547 LWG	SS
97	**Graphis neoraensis** Jagadeesh & G.P. Sinha	“	C	Cr	E	5826A BSA	NS
98	**Graphis parilis** Kremp.	“	C	Cr		3612A BSA	ES
99	**Graphis pavoniana** Fée	“	C	Cr		3747 BSA	ES
100	**Graphis pertricosa** (Kremp.) A.W. Archer	“	C	Cr		3666A BSA, 3790B BSA	ES, SS
101	**Graphis platycarpa** Eschw.	“	C	Cr		01-219567 LWG	SS
102	**Graphis proserpens** Vain.	“	C	Cr		3734 BSA, 3803 BSA	ES, SS
103	**Graphis scripta** (L.) Ach.	“	C	Cr		20-77182B LWG	ES
104	**Graphis semirigida** (Müll. Arg.) Lücking	“	C	Cr		3736 BSA	ES
105	**Graphis streblocarpa** (Bél.) Nyl.	“	C	Cr		01-67234 LWG	ES
106	**Graphis striatula** (Ach.) Spreng.	“	C	Cr		3593 BSA	ES
107	**Graphis subvittata** Adaw. & Makhija	“	C	Cr		5797 BSA	ES
108	**Graphis supertecta** Müll. Arg.	“	C	Cr		01-2663A LWG	ES
109	**Graphis tenella** Ach.	“	C	Cr		01-67231 LWG	ES
110	**Graphis tsunodae** Zahlbr.	“	C	Cr		3593 BSA	ES
111	**Graphis vittata** Müll. Arg.	“	C	Cr		3646 BSA	NS
112	**Gyalectidium filicinum** Müll. Arg.	Gomphillaceae	F	Cr		F491 BSA	SS
113	**Gyalidea corticola** Pooja Gupta & G.P. Sinha	“	C	Cr	E	3597 BSA	ES
114	**Haematomma leprarioides** (Vain.) Vain.	Haematommataceae	C	Cr		20-77079 LWG	ES
115	**Haematomma wattii** (Stirt.) Zahlbr.	“	C	Cr		1398B BSHC, 3802 BSA	ES, SS
116	**Hemithecium nakanishianum** (Patw. & C.R. Kulk.) Makhija & A. Dube	Graphidaceae	C	Cr		Bajpai & al. 2011	SS
117	**Herpothallon cinereum** G. Thor	Arthoniaceae	C	Cr		5634 BSA	ES
118	**Herpothallon echinatum** Aptroot	“	C	Cr		4480 BSA	ES
119	**Herpothallon flavominutum** Jagadeesh & al.	“	C	Cr	E	5558 BSA	ES
120	**Herpothallon granulosum** Jagadeesh & G.P. Sinha	“	C	Cr	E	5522 BSA	ES
121	**Herpothallon isidiatum** Jagadeesh & G.P.Sinha	“	C	Cr		5701 BSA	ES
122	**Herpothallon philippinum** (Vain.) Aptroot & Lücking	“	C	Cr		5648 BSA	ES
123	**Herpothallon sticticum** Jagadeesh & G.P. Sinha	“	C	Cr	E	5657 BSA, 5832 BSA	ES, NS

SI. no.	Lichen species	Family	Hb	Gf	E	Acce. No.	Loca–tion
124	**Ionaspis lacustris** (With.) Lutzoni	Hymeneliaceae	S	Cr		267 BSHC	NS
125	**Laurera sikkimensis** Makhija & Patw.	Trypetheliaceae	C	Cr	E	70.1970 AMH	ES
126	**Lecanora achroa** Nyl.	Lecanoraceae	C	Cr		20-77079C LWG	ES
127	**Lecanora argentata** (Ach.) Degel.	“	C	Cr		3647B BSA	ES
128	**Lecanora austrointumescens** Lumbsch & Elix	“	C	Cr		20-77012 LWG	ES
129	**Lecanora bicincta** Ramond	“	C	Cr		1189 BSHC	ES
130	**Lecanora chlarotera** Nyl.	“	C	Cr		3623 BSA	ES
131	**Lecanora chondroderma** Zahlbr.	“	M	Cr		353 LWG	ES
132	**Lecanora cinereofusca** H. Magn.	“	C	Cr		304 BSHC	WS
133	**Lecanora concilianda** Vain.	“	C	Cr		01-67232 LWG, 379 BSHC	ES, WS
134	**Lecanora coronulans** Nyl.	“	C	Cr		Bajpai & al. 2011	SS
135	**Lecanora fimbriatula** Stirt.	“	C	Cr		3647D BSA	ES
136	**Lecanora flavidofusca** Müll. Arg.	“	C	Cr		437 BSHC, 20-77084 LWS	WS, ES
137	**Lecanora gangaleoides** Nyl.	“	T	Sq		5894 BSA, 7174 BSA	ES, NS
138	**Lecanora helva** Stizenb.	“	T	Cr		Shukla & al. 2015	ES
139	**Lecanora himalayae** Poelt	“	C	Cr		76767 LWG	NS
140	**Lecanora horiza** (Ach.) Röhl.	“	C	Cr		5775 BSA	ES
141	**Lecanora iseana** Räsänen	“	C	Cr		293 LWG	ES
142	**Lecanora leprosa** Fée	“	C	Cr		1281 BSHC, 304 BSHC	SS, WS
143	**Lecanora luteomarginata** Nayaka & al.	“	C	Cr	E	893 BSHC	ES
144	**Lecanora phaeocardia** Vain.	“	C	Cr		677 BSHC	ES
145	**Lecanora pulicaris** (Pers.) Ach.	“	C	Cr		1371 BSHC	ES
146	**Lecanora queenslandica** C. Knight	“	C	Cr		2077116 LWG	ES
147	**Lecanora rugosella** Zahlbr.	“	S	Cr		297 LWG	ES
148	**Lecanora subimmersa** (Fée) Vain.	“	C	Cr		20-77179 LWG	ES
149	**Lecanora subrugosa** Nyl.	“	C	Cr		3601 BSA	ES
150	**Lecanora tropica** Zahlbr.	“	C	Cr		436 BSHC, 01-219518 LWG	WS, SS
151	**Lecidea confluens** (Weber) Ach.	Lecideaceae	C	Cr		1232 BSHC	NS
152	**Lecidella bullata** Körb.	Lecanoraceae	C	Cr		20-771200 LWG	ES
153	***Lecidella stigmatia** (Ach.) Hertel & Leuckert	“	C	Cr		1567 BSA	NS
154	**Letrouitia domingensis** (Pers.) Hafellner & Bellem.	Letrouitiaceae	C	Cr		5662B BSA	ES
155	**Malmidea fuscella** (Müll.Arg.) Kalb & al.	Malmideaceae	C	Cr		3648B BSA	ES
156	**Malmidea granifera** (Ach.) Kalb & al.	“	C	Cr		514 BSHC	ES

SI. no.	Lichen species	Family	Hb	Gf	E	Acce. No.	Loca–tion
157	**Marcelaria benguelensis** (Müll. Arg.) Aptroot & al.	Trypetheliaceae	C	Cr		01-219529B LWG	SS
158	**Maronea melanocarpa** (Müll. Arg.) Zahlbr.	Fuscideaceae	C	Cr		837 BSHC	WS
159	**Megalaria laureri** (Hepp. ex Th. Fr.) Hafellner	Megalariaceae	C	Cr		20-77064 LWG	ES
160	**Megalospora tuberculosa** (Fée) Sipman	Megalosporaceae	S	Cr		667 BSHC	NS
161	**Mycobilimbia hunana** (Zahlbr) D.D.Awasthi	Lecideaceae	C	Cr		95 BSHC	ES
162	**Mycomicrothelia minutula** (Zahlbr.) D. Hawksw.	Arthopyreniaceae	C	Cr		3596 BSA, 42 BSHC	ES, SS
163	**Myriotrema clandestinum** (Fée) Nyl.	Graphidaceae (sub-family = Graphidoideae)	C	Cr		5649 BSA	ES
164	**Ochrolechia pallescens** (L.) A. Massal.	Ochrolechiaceae	C	Cr		858 BSHC	WS
165	****Ochrolechia parella** (L.) A. Massal.	“	C	Cr		994 BSHC	NS
166	**Ochrolechia rosella** (Müll. Arg.) Verseghy	“	C	Cr		621A BSHC	NS
167	**Ochrolechia yasudae** Vain.	“	C	Cr		244 BSHC	WS
168	**Opegrapha xercica** Torrente & Egea	Opegraphaceae	C	Cr		7194 BSA	NS
169	**Pallidogramme chlorocarpoides** (Nyl.) Staiger & al.	Graphidacece	C	Cr		01-67273 LWG	WS
170	**Pallidogramme chrysenteron** (Mont.) Staiger & al.	“	C	Cr		3730 BSA	ES
171	**Pallidogramme nilgiriensis** (Kr.P.Singh & D.D. Awasthi) Kr.P.Singh & Swarnlatha	“	C	Cr	E	01-67223A LWG	ES
172	**Peltula obscurans** (Nyl.) Gyeln.	Peltulaceae	C	Cr		496A BSHC	WS
173	**Pertusaria amarescens** Nyl.	Pertusariaceae	C	Cr		20-77115 LWG	ES
174	**Pertusaria ceylonica** Müll. Arg.	“	C	Cr		20-77170 LWG	ES
175	**Pertusaria composita** Zahlbr.	“	C	Cr		993A BSHC	ES
176	**Pertusaria dehiscens** Müll. Arg.	“	C	Cr		01-26635A LWG	ES
177	**Pertusaria depressa** (Fée) Mont & Bosch	“	C	Cr		01-219544 LWG	SS
178	**Pertusaria hartmannii** Mull. Arg.	“	C	Cr		7523 BSA, 940C	NS, ES
179	**Pertusaria himalayensis** D.D. Awasthi & Preeti Srivast.	“	C	Cr	E	01-26633 LWG	ES
180	**Pertusaria indica** Preeti Srivast. & D.D. Awasthi	“	S	Cr	E	01-26630 LWG	ES
181	**Pertusaria leioplacella** Nyl.	“	C	Cr		Shukla & al. 2015	ES
182	**Pertusaria leucosora** Nyl.	“	C	Cr		20-77199 LWG	ES
183	**Pertusaria leucosorodes** Nyl.	“	C	Cr		20-77053 LWG, 20-77063 LWG	ES,SS
184	**Pertusaria leucostoma** (Bernh.) A. Massal.	“	C	Cr		01-67272B LWG	ES
185	**Pertusaria multipuncta** (Turn.) Nyl.	“	C	Cr		20-77036 LWG, 01-219555 LWG	SS,ES
186	**Pertusaria pallidula** Stirt.	“	C	Cr	E	20-77036A LWG	ES

SI. no.	Lichen species	Family	Hb	Gf	E	Acce. No.	Loca–tion
187	**Pertusaria pseudococcodes** Müll. Arg	“	C	Cr		20-77099 LWG	ES
188	**Pertusaria pustulata** (Ach.) Duby	“	C	Cr		20-77079 LWG, 01-26688 LWG	ES, SS
189	**Pertusaria quassiae** (Fée) Nyl.	“	C	Cr		01-26688 LWG	SS
190	**Pertusaria rigida** Müll. Arg.	“	C	Cr		20-77189 LWG	ES
191	**Pertusaria submultipuncta** Nyl.	“	C	Cr		20-77079 LWG	ES
192	**Pertusaria tropica** Vain.	“	C	Cr		-01–26688 LWG	SS
193	**Phaeographina firmula** (Stirt.) Zahlbr.	Graphidaceae	C	Cr	E	01-21950C	SS
194	**Phaeographina limbata** Müll. Arg.	“	C	Cr		01-217580	ES
195	**Phaeographis divaricoides** Räsänen	“	C	Cr	E	219 LWG	ES
196	**Platygramme caesiopruinosa** (Fée) Fée	“	C	Cr		20-77182B LWG	ES
197	**Platygramme pudica** (Mont. & Bosch) M.Nakan. & Kashiw.	“	C	Cr.		20-77079, 01-67220 LWG	ES, SS
198	**Platythecium albolabiatum**(Patw. & C.R. Kulk.) A.W. Archer	“	C	Cr		20-77036	ES
199	**Porina atrocoerulea** Müll. Arg.	Porinaceae	F	Cr		F57A BSA F424A BSA, F513B BSA	ES, SS, WS
200	**Porina conica** R. Sant.	“	F	Cr		F160A BSA	ES
201	**Porina dolichophora** (Nyl.) Müll. Arg.	“	F	Cr		01-26669 LWG	SS
202	**Porina kameruniensis** F. Schill.	“	F	Cr		F160A BSA	ES
203	**Porina limbulata** (Kremp.) Vain.	“	F	Cr		F514B BSA	WS
204	**Porina monocarpa** (Kremp.) F. Schill.	“	F	Cr		526C BSA	WS
205	**Porina subcutanea** Ach.	“	C	Cr		01-26609 LWG	ES
206	**Porina subhibernica** Upreti	“	C	Cr	E	01-2195510B	SS
207	**Porina tetracerae** (Afz.) Müll. Arg.	“	C	Cr		20-77064B	ES
208	**Porina trichothelioides** R. Sant.	“	F	Cr		F474 BSA, F533C BSA	SS, WS
209	**Porpidia crustulata** (Ach.) Hertel & Schwab	Lecideaceae	S	Cr		20-77157B, 1233 BSHC	ES, NS
210	****Porpidia flavicunda** (Ach.) Gowan	“	S	Cr		1233 BSHC	NS
211	**Porpidia macrocarpa** (DC.) Hertel & Knoph	“	S	Cr		218 BSHC	WS
212	**Psilolechia lucida** (Ach.) M. Choisy	Psilolechiaceae	T	Lp		20-77108 LWG	ES
213	**Psora himalayana** (C.Bab.) Timdal	Psoraceae	C	Cr		1779B BSHC	ES
214	**Pyrenula adacta** Fée	Pyrenulaceae	C	Cr		01-26638B LWG	ES
215	**Pyrenula anomla** (Ach.) Vain.	“	C	Cr		3799B BSA	SS
216	**Pyrenula astroidea** (Fée) R.C. Harris	“	C	Cr		01-219506 LWG	SS
217	**Pyrenula breutelii** (Müll. Arg.) Aptroot	“	C	Cr		4154 BSA	ES
218	**Pyrenula cayennensis** Mull.-Arg.	“	C	Cr		01-26610 LWG	ES
219	**Pyrenula complanata** (Mont.) Trevis.	“	C	Cr		3684 BSA	ES

SI. no.	Lichen species	Family	Hb	Gf	E	Acce. No.	Loca–tion
220	**Pyrenula cuyabensis** (Malme) R.C. Harris	"	C	Cr		01-21950 BSA	SS
221	**Pyrenula duplicans** (Nyl.) Aptroot.	"	C	Cr		3822A BSA, 177 BSHC	ES, WS
222	**Pyrenula globifera** (Eschw.) Aptroot	"	C	Cr		01-26607 LWG	ES
223	**Pyrenula immissa** (Stirt.) Zahlbr.	"	C	Cr		3625 BSA	ES
224	**Pyrenula interducta** (Nyl.) Zahlbr.	"	C	Cr		328 BSHC	WS
225	**Pyrenula leucostoma** Ach.	"	C	Cr		3750 BSA	ES
226	**Pyrenula leucotrypa** (Nyl.) Upreti	"	C	Cr		01-219569 LWG	SS
227	**Pyrenula ochraceoflavens** (Nyl.) R.C. Harris	"	C	Cr		01-219535 LWG	ES
228	**Pyrenula oculata** Ajay Singh & Upreti	"	C	Cr		01-219559 LWG	SS
229	**Pyrenula papillifera** (Nyl.) Aptroot	"	C	Cr		01-26638B LWG	ES
230	**Pyrenula platystoma** (Müll. Arg.) Aptroot	"	C	Cr		01-219584 LWG, 01-266701 LWG, 431 BSHC	ES, SS, WS
231	**Pyrenula punctella** (Nyl.) Trevis.	"	C	Cr		3779C BSA	SS
232	**Pyrenula quassiaecola** Fée	"	C	Cr		01-217582 LWG	ES
233	**Pyrenula subelliptica** (Tuck.) R.C. Harris	"	C	Cr		377A BSA	SS
234	**Rhizocarpon geographicum** (L.) DC.	Rhizocarpaceae	S	Cr		1161 BSHC	NS
235	**Rhizocarpon sikkimense** H. Magn.	"	S	Cr	E	1620 BSHC	NS
236	**Rhizocarpon superficiale** (Schaer.) Malme	"	C	Cr		Awasthi & Singh 1977	ES
237	**Rinodina sophodes** (Ach.) A. Massal.	Physciaceae	C	Cr		20-77105 LWG	ES
238	**Sarcogyne sikkimensis** Räsänen	Acarosporaceae	S	Cr	E	Räsänen 1950	-
239	***Sclerophora pallida** (Pers.) Y.J.Yao & Spooner	Coniocybaceae	C	Cr		7186 BSA	NS
240	**Sporopodium awasthianum** Kr.P.Singh & Pinokiyo	Pilocarpaceae	F	Cr		F416 BSA	SS
241	**Sporopodium phyllocharis** (Mont.) A. Massal.	"	F	Cr		F489A	SS
242	**Sporopodium xantholeucum** (Müll. Arg.) Zahlbr.	"	F	Cr		F417 BSA	SS
243	**Strigula antillarum** (Fée) Müll. Arg.	Strigulaceae	F	Cr		F160B BSA, F424 BSA, F492 BSA	ES, SS, WS
244	**Strigula concreta** (Fée) R. Sant.	"	F	Cr		F359A BSA, F395A	ES, SS
245	**Strigula maculata** (Cook & Masse) R. Sant.	"	F	Cr		F316D BSA, F427 BSA, F533D	ES, SS, WS
246	**Strigula nemathora** f. **hypothelia** (Nyl.) Lücking	"	F	Cr		F359B BSA	ES
247	**Strigula nitidula** Mont.	"	F	Cr		F360 BSA, F383, F522	ES, SS, WS
248	**Strigula orbicularis** Fr.	"	F	Cr		F160 BSA, F499 BSA, F500	ES, SS, WS

SI. no.	Lichen species	Family	Hb	Gf	E	Acce. No.	Loca–tion
249	**Strigula phyllogena** (Müll. Arg.) R.C. Harris	“	F	Cr		F322	ES
250	**Strigula smaragdula** Fr.	“	F	Cr		F362 BSA, F338 BSA, F346 BSA	ES, SS, WS
251	**Strigula subelegans** Vain.	“	F	Cr		F370 BSA, F459B, F518	ES, SS, WS
252	**Synarthonia sikkimensis** S. Joseph & G.P. Sinha	Arthoniaceae	C	Cr	E	7192 BSA	NS
253	**Tapellaria epiphylla** (Müll. Arg.) R. Sant.	Pilocarpaceae	F	Cr		F154, F470B	ES, SS
254	**Tapellaria saxicola** Vězda & Poelt	“	S	Cr		77166 LWG	ES
255	**Tephromela khatiensis** (Räsänen) Lumbsch	Tephromelataceae	S	Cr		20-77178 LWG, 1189 BSHC, 1299 BSHC	ES, NS, WS
256	**Thelenella indica** Pinokiyo & Kr. P. Singh	Thelenellaceae	F	Cr	E	F315 BSA	ES
257	**Tricharia vainioi** R. Sant.	Gomphillaceae	F	Cr		F369 BSA	ES
258	**Trypethelium albopruinosum** Makhija & Patw.	Trypetheliaceae	C	Cr	E	01-67231C LWG	ES
259	**Trypethelium eluteriae** Spreng.	“	C	Cr		3827 BSA	ES
260	**Trypethelium endosulphureum** Makhija & Patw.	“	C	Cr	E	01-67266 LWG, 01-67265 LWG	ES, SS
261	**Trypethelium refertum** Stirt.	“	C	Cr		01-217576 LWG	ES
262	**Trypethelium variolosum** Ach.	“	C	Cr		01-217564	ES
263	**Tylophoron moderatum** Nyl.	Arthoniaceae	C	Cr		3714 BSA	SS
264	**Typlophoron nidulans** Strit.	“	C	Cr		5554 BSA	ES
265	**Tylophoron protrudens** Nyl.	“	C	Cr		3686 BSA	ES
266	**Verrucaria coerulea** (Ramond) DC.	Verrucariaceae	S	Cr		20-77175B LWG, 158 BSHC, 574 BSHC	ES, WS, NS

[*Abbreviations used*: Acc. No. = accession number with herbarium acronyms; C = corticolous; Cr = crustose; E = Endemic; ES = East Sikkim; F = foliicolous, Fo = foliose; Fr = fruticose; Gf = Growth form, Hb = Habitat, Lp = leprose; M = muscicolous; NS = North Sikkim; S = saxicolous; SS = South Sikkim; Sq = squamulose; T = terricolous; WS = West Sikkim; **= new to India; * new to Sikkim]

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